ECES 521, Homework 3

October 9, 2013

Name:

Student ID:
1. A certain sick person either has flu type A or flu type B. The center for disease control has observed that flu type A occurs half as often as flu type B in the population. Among those sick people having flu type A, 35% report having a fever, while among those sick people having flu type B, 70% report having a fever. Among those sick people having flu type A, 5% report having nausea, while among those sick people having flu type B, 20% report having nausea. Among those sick people having flu type A, 37% report having either fever or nausea or both, while among those sick people having flu type B, 80% report having either fever or nausea or both.

(a) Based on this information, suggest a probability $P[A]$ for the event $A$ and a probability $P[B]$ for the event $B$, indicating the probability that a given person with the flu has flu type A and B, respectively.

(b) Let $F$ and $N$ be the event that this person has a fever and nausea, respectively. Based on the information above, suggest values for the conditional probabilities $P[F|A], P[N|A], P[F|B], ~and~ P[N|B]$.

(c) Given the information above, suggest values for $P[F \cup N|A], P[F \cup N|B]$, and $P[F \cap N|A], P[F \cap N|B]$.

(d) Are events $N$ and $F$ conditionally independent given event $A$? Justify your answer.

(e) Given that this sick person is now observed to have both fever and nausea, what is your revised probability that they have fever type A and fever type B, respectively. (I.E. calculate $P[A|N \cap F]$ and $P[B|N \cap F]$).

2. Given that a randomly selected five card hand from a normal 52 card deck has at least one pair (exactly two of one number)

(a) What is the conditional probability that it is a full house (this pair and three of another number)?

(b) What is the conditional probability that it is a two pair hand (two of one number, two of another number, and one of a third number)?

3. Given that a randomly selected five card hand from a normal 52 card deck has at least two cards of the same number

(a) What is the conditional probability that it is a full house (this pair and three of another number)?

(b) What is the conditional probability that it is a two pair hand (two of one number, two of another number, and one of a third number)?

4. Each customer arriving at a particular service desk is happy with probability $p$ and unhappy with probability $1 - p$

(a) Define the random variable that is the number of customers that arrive at a desk before the first unhappy customer arrives. What is the name of this type of distribution for a random variable? What is the PMF of this random variable?

(b) In a certain day $N$ customers arrived at the desk. Given this information, define the random variable that was the number of happy customers that arrived at that desk during the day. What is the name of this type of distribution for a random variable? What is the PMF of this random variable?